MICROFICHED

V08021

STEP/SCAN LOCKOUT

FOR THE

WJ-8615 RECEIVER

INSTRUMENT SHOP

WATKINS-JOHNSON

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WATKINS-JOHNSON COMPANY
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MD. 20878

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WARNING

This unit employs voltages that are dangerous and may be fatal if contacted. Exercise extreme caution when working on this unit with any of the protective covers removed.

PROPRIETARY STATEMENT

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SCAN SYNCHRONIZATION

In addition to the operational data provided in the **Scan/Step Lockout** manual, this option provides a series of synchronization pulses at pin 8 of rear panel connector J13 (AUX). At the initialization of each scan operation, and each time that the sector is rescanned, an active low pulse ranging from 500 usec to 2 msec in duration is output at J13 pin 8. At each frequency increment within the scan sector, the receiver will again provide an active low pulse for use as a sync pulse for external devices. If the frequency of the scan increment is at a locked out frequency, the output pulse will have a duration of from 16 to 64 usec. For normal frequency increments (frequencies that are not locked out), the output at J13 pin 8 will be active low for a duration of from 80 to 140 usec.

The synchronization output is typically used as a trigger for external devices to synchronize the reading of the receiver's Log Video Output (J13 pin 9) with the scan operation. At each scan increment, the Log Video Output provides a DC voltage in the range of from 0 to 5V, to reflect the signal strength at that frequency (0 = no signal activity, +5V = a signal level of 55 dB or more above the sensitivity level of the selected IF bandwidth). Since the Log Video level is constantly changing during a scan, the synchronization output may be used to trigger the reading of the level each time that a scan increment is taken. The OV level may vary from the sensitivity of the selected IF bandwidth at different RF/IF gain settings of the receiver and also when the receiver is in the AGC mode of operation, due to the action of the receiver's gain control circuitry. However, the Log Video output will still reflect approximately 55 dB of range.

TABLE OF CONTENTS

Paragraph		Page
1.1	General Description	1-1
1.2	Functional Description	1-2
1.3	Calibration	1-4
1.4	Step/Scan Modes	1-4
1.4.1	Mode 1	1-5
1.4.2	Mode 2	1-5
1.4.3	Mode 3	1-5
1.4.3.1	Queue Operation	1-6
1.5	Step/Scan Variations	1-6
1.6	Operation	1-6
1.6.1	Step Operation	1-7
1.6.2	Scan Operation	1-10
1.6.3	Scan Lockout	1-12
1.7	Scan and Step Times	1-18
1.7.1	Scan Time	1-18
1.7.2	Step Time	1-19
1.8	SSL Retrofit	1-19
1.9	Parts List	1-20

LIST OF TABLES

Table		Page
1-1	Step/Scan Modes and Variations	1-7
1-2	Step Commands	1-9
1-3	Scan Commands	1-11
1-4	Scan Lockout Command	1-13
1-5	Step/Scan Lockout Remote Commands	1-14
1-6	Error Messages	1-17

STEP/SCAN LOCKOUT OPITON

1.1 GENERAL DESCRIPTION

Step-Scan-Lockout (SSL) provides the WJ-8615 Receiver with the capabilities of stepping through preprogrammed discrete frequencies (Step mode), or scanning across predetermined frequency segments (Scan mode). Scan mode has the ability to not respond to certain frequencies (Lockout). In either Step or Scan mode, the selected COR level determines the signal threshold that must be exceeded for the receiver to lock onto that frequency. When a Step frequency or a signal within a frequency scan exceeds the set COR level, the receiver tuning stops. The WJ-8615 Receiver remains locked onto the received signal as long as the signal level is above the COR level or until the receiver is commanded to resume its frequency search. Lockout is utilized to prevent the receiver form locking onto known or undesired signals. In Scan mode, frequency segments may be excluded from a scan.

Set up and control of Step-Scan-Lockout (SSL) is provided only via the WJ-8615 remote interface connector. Using the remote commands listed in **Table 1-5**, a suitable controller connected to the receiver's remote interface connector is able to set, verify and change the SSL functions.

Scan mode allows the receiver to tune across predetermined segments of the frequency spectrum. Scanning allows the receiver to tune from a start frequency to a stop frequency in selected increments. Start frequency, stop frequency and increment size are determined remotely by the operator. Start and stop frequencies are selectable from 20-500 MHz (20-1100 MHz with the Frequency Extender option). Increment selection is from 10 kHz to 1 MHz (in 5 kHz increments).

NOTE

In Scan, the start frequency must be less (lower in frequency) than the stop frequency.

During Scan, the receiver tunes from the start frequency to the stop frequency. The receiver scans the frequency spectrum, from the start to the stop frequency in selected frequency steps (determined by the increment size). While the receiver scans through each band, any signal activity greater than the set COR level causes the scan to halt.

Step mode allows the operator to select particular frequencies for the receiver to sample. Step frequencies can be in any order, independent of frequency. During Step mode, the receiver samples the frequency spectrum only at the discrete frequencies programmed in memory.

Lockout provides the operator with the ability to eliminate selected frequency segments during Scan operation. Lockout prevents the receiver from recognizing signals within the lockout frequency segment.

1.2 FUNCTIONAL DESCRIPTION

The Scan-Step-Lockout function utilizes 2k bytes of random access memory dedicated to SSL operation. This memory space contains all of the receiver parameters required for SSL operation. The allotted memory permits up to 71 memory channels, for storage of Scan/Step parameters, or up to 142 memory channels for Lockout data. Each of the Scan/Step channels store a complete set of receiver parameters including: tuned frequency, IF bandwidth number, COR level, detection mode, status of AGC and AFC, RF gain, and BFO frequency. Memory channels designated to store lockout data hold the center frequency and width of each of the frequency segments to be locked out during the Scan operation.

Before programming SSL data into the receiver memory, SSL memory should be partitioned. Partitioning memory allows the operator to designate the number of channels into which Scan/Step data can be stored. Without partitioning memory, all 71 channels are allocated for Scan/Step data. Partitioning memory designates Step/Scan channels from 0, up to the value of the partition command. The remaining memory channels are for Lockout data. When partitioning memory, the number of unused storage channels, times two (x2) produces the number of remaining Lockout channels. Each Step/Scan storage channel subtracts two (-2) from the number of Lockout channels available.

NOTE

Partitioning memory clears all data previously stored in memory.

Sending a partition query returns the memory configuration by returning the value sent in the last partition command. Partition queries do not cause memory data to be lost. The following remote commands are used to partition memory and to verify the memory allocation.

Command	Description
PAR XX	Partitions memory to allow Step/Scan data storage from channel 0 through XX (XX=0 to 71)
PAR?	Requests the receiver's memory storage configuration.

Once memory has been partitioned, Step/Scan and Lockout data may be stored via two methods. The first method requires that a complete string of data be sent, in a specified order, and stored in the designated memory channel. Once the data has been stored in the specified memory channel, updating may be performed by using an abbreviated form of the first method. This abbreviated data string requires that all fields, prior to the parameter to be changed, be sent in their appropriate order. However, only fields that are to be changed need to contain valid data. The second method of memory storage consists of only a storage command and the designated channel number to be programmed. When this command is sent,

all current front panel receiver settings are stored in the designated memory channel. The ASCII format for Scan/Step programming is as follows:

SCH mch,chn,frq,bw,cor,det,afc,agc,rfg,bro

SCH - storage channel
mch - memory channel number
chn - channel flag (CHN,CHN/)
frq - frequency (in MHz)
bw - bandwidth (1-5)
cor - COR level (0-80)
det - detection (AM,FM,CW,PLS,USB,LSB,ISB)
afc - (AFC,AFC/)
agc - (AGC,AGC/)
rfg - RF gain (0-255)
bfo - BFO frequency (in KHz)
sto n - store receiver parameters in channel n

The binary format for Scan/Step programming is as follows:

30 b b pppp b b b b b b pppp

Ledgend

chr	used in command	used in response
b	Is a single byte of data	Is a single byte of data
p	Is a packed BCD byte of data	Is a packed BCD byte of data
n	Is 1-3 ASCII digits used as a number.	Is a space and 3 ASCII digits

In addition to the memory commands that are available for memory programming, a number of commands are provided to recall the memory channels to review the stored data. These queries permit an operator to request data stored in any of the Scan/Step or Lockout channels. Using these commands any channel may be requested over the remote bus or the channel can be recalled and executed, setting the receiver to the parameters stored in memory. Recall of memory is performed using the following commands:

ASCII		BINARY		
COMMAND	RESPONSE	COMMAND	RESPONSE	DESCRIPTION
RCE n		27b		Recall and execute memory channel n
RCH n?	SCH mch,chn,frq,bw,cor,det,aft,agc,rfg,bfo	2A b	30 b pppp b b b b b b pppp	Recall Channel in format of SCH command.

1.3 CALIBRATION

Calibration of the 2nd LO is required before a Scan or a Step is initiated. If an attempt to scan or step is made before the 2nd LO has been calibrated, an error 815 occurs and scan or step is not permitted. The 2nd LO must first be calibrated using the calibration command or the Edit Option during power up. Also if an attempt to Scan or Step is made before the receiver has been powered up for 45 minutes, an error 817 occurs, warning the operator of an insufficient warm up, but normal Scan is allowed. If this error occurs, the receiver will recalibrate itself after is has been on for 45 minutes.

After power up, the initial Scan/Step command causes the receiver to calibrate itself in 10 kHz steps to prepare for Scan. This calibration should take no longer than 30 seconds. Subsequent checks of calibration occur at 2-3 minutes intervals during the first 45 minutes of receiver operation and then every 15 minutes thereafter. These subsequent calibrations should take no longer than 250 ms unless the receiver drifts excessively, in which case a full 30 second recalibration will occur.

The automatic calibration mode (ACL) has been included to provide greater operator flexibility and control over the automatic recalibration function. While in the ACL mode, the receiver automatically recalibrates. When the ACL mode is not selected, the receiver performs the 250ms calibrations as required. However, the receiver first asks permission of the controller to perform the full 30 second calibration by: setting the SRQ and ERROR bits in the status register, and Error 470. The controller may respond by sending CAP (CAlibration AProved). The controller should note that when error 470 occurs, receiver frequency has drifted sufficiently and any Scan or Step performed is inaccurate.

The following remote controls are utilized for the purposes of 2nd LO calibration.

ASCII		HEX		
Command	Response	Command	Response	Description
ACL		09		Enable auto calibration as required by receiver.
ACL/		0A		Cause receiver to wait for calibration approval before doing calibration
ACL?	ACL or ACL/	0B	09 or 0A	Return auto calibration status
CAP		0F		Allow calibration command. This command should be issued in response to error 70 (request for calibration approval).

1.4 STEP/SCAN MODES

Three Scan/Step modes of operation are provided for WJ-8615 Receivers equipped with SSL. The desired Scan/Step mode must be selected before initiating either a Scan or a Step operation. Selection of the Scan/Step mode determines the receiver response during a Scan or Step operation when a signal greater than the COR level is encountered.

1.4.1 MODE 1

In Mode 1, the Scan or Step operation stops whenever a signal encountered exceeds the selected COR level. The Step or Scan operation does not continue until:

1) Signal level drops below set COR level
2) A Scan or Step command is received

When signal activity exceeds the programmed COR level, the receiver sets bit 6 of the status byte (providing STS 1 has been sent to enable this interrupt). Bit 6 of the status byte indicates a request for service. The SRQ bit (bit 6) is set when a signal level is greater than the set COR level or the received signal drops below the COR level setting. The status byte the receiver sends to the controller, in response to a serial poll, is defined as follows:

Bit	Value	Function	Cleared by
0	1	Indicates signal greater than COR level	Non-latched indicator.
1	2	Unit power up	Requesting status (STS?).
2	4	Queue if full	Reading queue
3	8	Scan or Step sequence complete (must be in single sequence)	Sending Scan/Step continue command.
4	16	Unit is busy. Output buffer has data to be sent	Non-latched indicator.
5	32	Error detected	Requesting error #. (ERR? will have most current error).
6	64	RVS request for service. Set by this unit	Serial poll
7	128	Lo lock indicator. Set is unlocked	Non-latched indicator.

1.4.2 MODE 2

In Step/Scan Mode 2, the Step or Scan operation is identical to Mode 1, until a signal greater than the programmed COR level is encountered. When a received signal level exceeds the set COR level, the receiver is placed in either Step Continue or Scan Continue. When a signal level exceeds the programmed COR level, the SRQ bit is set providing the SRQ has been enabled via previously sending STS 1. The receiver cannot resume stepping or scanning until a step or scan command is sent to the receiver from the remote controller.

1.4.3 MODE 3

In Step/Scan Mode 3, the receiver operates the same as Mode 1 or Mode 2, until a signal greater than the selected COR level is encountered. Signals greater than the set COR level cause the receiver to halt, only long enough to store the signal frequency into a buffer before resuming either Step or Scan operation.

NOTE

The WJ-8615 Receiver defaults to Scan/Step Mode 1.

1.4.3.1 Queue Operation

While the receiver is in MODE 3 (Auto Queue) the queue is filled using a first in first out approach. If Variation 3 is disabled, the oldest data in the queue is over written first. The queue may be querried (emptied) at any time using the QUE? command. The receiver responds with up to the most recent 16 signals it has found.

ASCII		HEX		
Command	Response	Command	Response	Description
QUE?	QUE	26	24	Return all frequencies that have been queued, if queue is empty no frequencies are returned.
	QUE f,f,f...		24pppp pppp...	Return frequencies in queue up to a maximum of 16 frequencies.

Ledgend

chr	used in command	used in response
b	Is a single byte of data	Is a single byte of data
p	Is a packed BCD byte of data	Is a packed BCD byte of data
n	Is 1-3 ASCII digits used as a number	Is a space and 3 ASCII digits
f	Is a maximum of 4 ASCII digits, a a decimal and 4 more ASCII digits	Is 4 ASCII digits, a decimal and 4 ASCII digits.

1.5 STEP/SCAN VARIATIONS

The three Scan/Step Modes can be varied, depending on the mode selected. The variations affect different modes of Step/Scan operation. These variations may be used to modify the standard Scan/Step Modes. The variations are as follows:

Variation 1: (Stop on end of Scan/Step) - The receiver scans according to the mode set, but stops, enters Scan/Step continue mode and sets SRQ at the end of each Scan/Step sequence. This variation may be used in all three modes.

Variation 2: Auto Signal Log - In normal operation the receiver only detects the leading edge of a signal that exceeds the set COR level and reports that frequency to the operator. This avoids repetative logging of large or wide band signals when scanning in narrow bandwidths. If desired, enabling this variation allows the receiver to log each frequency where energy is detected. This option is valid in all three modes.

Variation 3: (Stop on full queue) - The receiver stops **and enters Scan/S**tep continue mode when the queue is filled and SRQ is set. This variation is only valid in MODE 3.

Table 1-1 lists the remote commands required to select the desired Step/Scan Mode and variations.

Table 1-1 Step/Scan Modes and Variations

Command	Bit Value	Description
STS/CFG	1	Set SRQ on signal activity (loss or acquisition)
STS/CFG	2	Cause AGC to reattack signals on receipt of new frequency over IEEE-488 interface bus.
STS/CFG	4	MODE 2
STS/CFG	8	Variation 1
STS/CFG	16	MODE 3
STS/CFG	32	Variation 3
STS/CFG	64	Variation 2
STS/CFG	128	N/U

NOTES: MODE 1 is enabled by disabling both MODE 2 and MODE 3.
MODE 2 and MODE 3 cannot be enabled simultaneously.
Variation 3 is valid only when MODE 3 is enabled.
The last CFG/STS command sent dictates all modes.

1.6 OPERATION

1.6.1 STEP OPERATION

In Step Operation, the receiver steps through up to 72 programmed memory channels. Each memory channel is programmed with a complete set-up of receiver parameters. Frequencies in the memory channels may be stored in any order for Step operation. Before initiating Step operation, Stop/Scan Mode and Variation must be selected and type of Step selected. Refer to Modes and Variation paragraphs (SCAN/STEP) for selection of the mode of operation. There are four types of Step operation:

1. Step Resume - Resumes from current memory channel Step. Operates only with receiver in step continue.

2. Sequential - Step from channel zero to user defined channel in sequence.

3. Sequential Sector - Step from user defined channel "N" to user defined channel "M" in sequence. (Channel No. M must be greater than N).

4. Random - Step from user defined channel N to any other user defined channel not in sequence. (Memory channels must be preprogrammed).

Step operation may change to step continue operation based on Mode or Version choices. Step Continue operation is similar to manual operation, allowing the receiver to accept new commands, while remembering the channel it was at when entering step continue operation. As long as manual operation is not selected or Step channels are not changed, Step may be continued from the channel at which it was stopped. Sending a manual command, while in step continue operation, places the receiver in manual operation.

While in Step operation, the receiver stops on signals greater than the set COR level, enters step continue or queue the signals found. The mode selected before the Step was started determines the action taken when a signal is encountered. If the SRQ for signal activity is enabled the receiver sets SRQ as signals are found in Step. When the receiver stops on a signal in Step, while not in queue mode, the LO locks on that frequency. If any readings such as signal strength, FM offset or other detectors are to be taken of that signal, the computer should monitor the LO lock indicator (bit 7) in the status byte before taking the readings. Sending a manual command while in Step, places the receiver into step continue operation. If local is entered, while in Step operation, the receiver exits Step or step continue and enters manual.

Since lockouts are not functional in Step mode, a convenient method of enabling or disabling a channel from a step sequence is available. Using a combination of the SCH and the CHN (CHaNnel status) command, an operator may exclude or include a previously programmed step channel in a step sequence. For example; to exclude channel number 2 fom a step sequence of channel 0,1,2,3,4 send the receiver:

SCH 2,CHN/

This command may be sent to the receiver at any time, including during Step, to facilitate quick changes. To reenable channel 2 again, send the receiver:

SCH 2,CHN

In order for a channel to be included in a step sequence the channel must first have been included in the step command. If the receiver step sequence is 0,1,2,3; channel 8 may not be included using the above procedure. **Table 1-2** lists the step commands required to control the receiver during Step operation.

Table 1-2. Step Commands

ASCII Command	Hex Command	Description
STP	8D	Resume Step from Step continue operation use previous issued channel.
STP n	8D b	Start Step using channel specified in argument. Step from 0 to the desired memory channel n.
STP n-n	8D b b	Start Step seqentially using the first memory channel as start channel and the second as stop channel.
STP n,n,n	8E b b b	Start Step using channel specified in memory channel n, step from memory channel n to any other memory channel n (Memory channels must be pre-programmed memory channels)
SCHn,CHN/	30 b 0C	Disable memory channel n from a step sequence
SCHn,CHN	30 b 0D	Enables memory channel n to be included in step sequence.

Ledgend

chr	used in command	used in response
b	Is a single byte of data	Is a single byte of data
p	Is a packed BCD byte of data	Is a packed BCD byte of data
n	Is 1-3 ASCII digits used as a number	Is a space and 3 ASCII digits
f	Is a maximum of 4 ASCII digits, a a decimal and 4 more ASCII digits	Is a space, 4 ASCII digits, a decimal and 4 ASCII digits.

NOTE

During Step operation in bandwidths less than 20 kHz, the calibration accuracy (±6 kHz) reduces the reliability.

1.6.2 SCAN OPERATION

Scan operation in the WJ-8615 Receiver allows the receiver to tune between two operator programmed frequencies. The Scan must be in ascending frequency order. The start frequency, set-up parameters and stop frequency of a Scan must be programmed in the receiver memory before Scan can be started. The frequency increment to be used for the Scan may be operator specified. Once Scan is started, its operation is dictated by the modes and variation selected. Scan increments may be operator selected or one of the bandwidth related increments may be used for Scan operation. Allowable scan increments range from 10 kHz to 1 MHz in 5 kHz increments. This command is sent in MHz. Increments of less than 5 kHz are rounded to the nearest 5 kHz frequency step. Setting the scan increment to 0 causes the receiver to scan in frequency increments of the bandwidth or half bandwidth. The choice of half or full bandwidth increments is based on the FBW or FBW/ command. The default mode of operation for the receiver is SCI 0 (scan increment of 0) and FBW/ (half bandwidth steps).

Scan start and stop parameters may be entered into any of the memory channels. The memory channel contains the start frequency and the receiver set-up parameters to be used during Scan. These parameters include: bandwidth, COR level, Detection mode, AGC status, AFC status, RF gain level and BFO frequency. The stop frequency memory channel only contains the stop frequency. Scan may be started once this information has been loaded into a pair of channels, the mode and the variation have been selected.

Scan is started with one of the following types of commands. Specifing one number with the Scan command causes the receiver to Scan using that number as a memory channel start frequency and the set-up parameters of that memory channel. The next higher channel number specifies the Scan stop frequency. When specifing two memory channel numbers with the Scan command, the first specifies the channel start frequency and set-up parameters and the second specifies the channel with the stop frequency. After Scan has been started and then enters scan continue mode is entered the Scan command (with no memory channel number) continues the Scan from the current frequency.

Scan operation may change to scan continue operation based on Mode or Variation choices. Scan continue operation is similar to manual operation, allowing the receiver to accept new commands while remembering the frequency it was at when entering scan continue operation. As long as manual operation is not selected or scan channels are not changed, the Scan may continue from the frequency at which it stopped. Sending a manual command, while in the scan continue operation, places the receiver in manual operation.

While in Scan operation, the receiver locks onto a signal and enters scan continue or queue the signals found. The Mode selected before Scan was started determines the action taken when a signal is encountered. If the SRQ bit for signal activity is enabled, the receiver sets the SRQ bit as signals are found in Scan. When the receiver stops on a signal in Scan, while not in queue mode, the LO locks at that frequency. If any readings such as, Signal Strength, FM Offset or other detectors are to be taken of that signal, the computer should monitor the LO lock indicator (bit 7) in the status byte before taking the readings. Sending a manual command while in Scan places the receiver into scan continue operation. If Local is entered, while in Scan operation, the receiver exits Scan or scan continue and enters manual. **Table 1-3** lists the Scan commands.

Table 1-3. Scan Commands

ASCII Command	ASCII Response	HEX Command	HEX Response	Description
SCN		84		Continue Scan from scan continue operation. Use previous issued channel.
SCN n		84 b		Start Scan using channel specified in memory channel n. Scan from memory channel n to memory channel n +1.
SCN n-n		84 b b		Start Scan using from memory channel as start channel and second as stop channel.
MAN		75		Stop Scan. Enter scan continue mode if in Scan, enter manual if in scan continue.
SCI f		06 p p p p		Scan increment frequency (in MHz). Selectable from 10 kHz to 1 MHz in 5 kHz increments. (SCI 0 selects FBW, FBW/)
SCI?	SCI f	08	06 p p p p	Return current scan increment.
FBW		D8		Select full bandwidth scan increment.
FBW/		D9		Select half bandwidth scan increment.
FBW?	FBW FBW/	DA	D8 D9	Return bandwidth increment

Ledgend

chr	used in command	used in response
b	Is a single byte of data	Is a single byte of data
p	Is a packed BCD byte of data	Is a packed BCD byte of data
n	Is 1-3 ASCII digits used as a number	Is a space and 3 ASCII digits
f	Is a maximum of 4 ASCII digits, a decimal and 4 more ASCII digits	Is a space, 4 ASCII digits, a decimal and 4 ASCII digits.

NOTE

Scan operation in bandwidths less than 20 kHz is not recommended due to the calibration accuracy of ±6 kHz.

1.6.3 SCAN LOCKOUT

Scan Lockout allows specified segments of the frequency spectrum to be skipped by the Scan operation. Lockouts are specified in terms of center frequency and width. Each Lockout is stored in the part of memory previously specified by the Partition command. There are two methods to entering a Lockout into memory. One method is by entering center frequency and width. The other method is to issue a command to lock out the current frequency and twice the selected bandwidth. Each time a Lockout is entered the receiver arranges the list in decending frequency order. Lockouts may have overlapping coverage, allowing the width of one Lockout to extend into the width of another. Each Lockout entered increments the lockout memory channel number. Lockouts may be deleted either by channel number of by center frequency. Each Lockout deleted decrements the lockout memory channel number by one.

A Scan Lockout is stored using the lock frequency command. This command allows a Lockout to be stored by providing the center frequency of the Lockout (in MHz) and the width in (in MHz). The center frequency may be any tuning frequency that is valid for the receiver. The width may be from 10 kHz to 99.99 MHz in 10 kHz increments (specified in MHz). The receiver must be in either manual or scan continue mode to accept the Lockout. If the receiver is in scan continue mode when the lockout is sent, the Lockout is stored in lockout memory, but is not used until the Scan command with a memory channel number is sent. Sending Scan with no number does not use any of the Lockouts sent while in continue operation.

A Scan Lockout may be stored using the lock command. This command locks out the current frequency and uses twice the bandwidth for the width specifier. This type of Lockout follows the same rules as for the lock frequency command. Bandwidths that are not even 10 kHz increments are truncated to the nearest 10 kHz multiple. The lock command follows the same rules as the lock frequency command; concerning when it may be sent and how it will be used.

Lockout may be deselected by either of two methods. To use either method the receiver must be in either manual or scan continue operation. If the receiver is in scan continue, the lockout is not deleted from the active scan until Scan is restarted using the Scan number command. One method to delete a Lockout is by center frequency. The unlock frequency command removes the first Lockout encountered in the lockout memory with that exact center frequency. If more than one Lockout exists with the same center frequency, unlock frequency one command must be used to remove each frequency from the lockout memory. If an unlock frequency command is sent and there is no corresponding frequency in lockout memory an Error 816 is generated. The other method of removing a Lockout from lockout memory is to use the unlock channel number command. Each Lockout is given a channel number as it is entered into memory. The highest frequency Lockout is stored at channel 1. Using the recall lockout command, Lockouts are returned to the computer in the lockout frequency format, allowing the lockout list to be searched by a computer in a non-destructive manner. Then, using the unlock channel number command, the Lockout may be removed. Trying to unlock or recall a non-existant Lockout channel causes an Error 816 to be generated. To aid in recalling a list of Lockouts a recall last lockout number command is available. This command returns the channel number of the last lockout channel used. The Scan Lockout commands are listed in **Table 1-4.**

Table 1-4. Scan Lockout Command

ASCII Command	ASCII Response	HEX Command	HEX Response	Description
LKF f,f		1E p p p p p p		Locks center frequency in first memory channel and width in second memory channel. In binary, the first 4 bytes are center frequency and last 2 bytes are width: 10 MHz, 1 MHz, 100 kHz, 10 kHz.
LCK		94		Locks current frequency and uses twice the bandwidth as frequency width memory channel.
ULC n		33 b b		Unlocks channel number in memory channel n.
ULF f		36 p p p p		Unlocks center frequency in memory channel.
RLK n?	LKF f,f	2D b b	1E p p p p p p	Returns center frequency and width of Lockout channel in memory n.
LCH?	LCH n	1D	1B b b	Returns number of last Lockout used.

Legend

chr	used in command	used in response
b	Is a single byte of data	Is a single byte of data
p	Is a packed BCD byte of data	Is a packed BCD byte of data
n	Is 1-3 ASCII digits used as a number	Is a space and 3 ASCII digits
f	Is a maximum of 4 ASCII digits, a decimal and 4 more ASCII digits	Is a space, 4 ASCII digits, a decimal and 4 ASCII digits.

Table 1-5 lists the commands used to control the Step/Scan Lockout operation of the WJ-8615 Receiver. **Table 1-6** lists the Error messages and their associated cause.

Table 1-5. Step/Scan Lockout Remote Commands

ASCII Command	ASCII Response	HEX Command	HEX Response	Description
ACL		09		Select auto calibration
ACL/		0A		Require calibration approval.
ACL?	ACL	0B	09	Return auto calibration status
	ACL/		0A	
CAP		0F		Calibration approved.
CFG n		12 b		Sets configuration mode and variation
CFG?	CFG n	14	12 b	Returns current configuration.
CHN		0C		Enables the channel on status flag for storage.
CHN/		0D		Disables channel on flag.
CHN?	CHN	0E	0C	Returns status of channel flag.
	CHN/		0D	
CLC		15		Cleans all Lockout channels.
FBW		D8		Selects full bandwidth scan increment.
FBW/		D9		Selects half bandwidth scan increment.
FBW?	FBW	DA	D8	Returns bandwidth increment status.
	FBW/		D9	
LCH?	LCH n	1D	1B b b	Returns number of last Lockout used.
LCK		94		Locks current frequency and uses bandwidth as frequency width argument.
LKF f,f		1E p p p p p p		Locks center frequency in first argument. Width in second argument. In binary first 4 bytes are center frequency, last 2 are width 10 MHz,1 MHz,100 kHz,10 kHz.
MAN		75		Stops Scan. Enter scan continue mode if in Scan. Enters manual if in Scan continue.
MOD?		B3		Returns current receiver mode.
	MAN		75	Manual
	SCN		84	Scan
	SCM		B2	Scan continue
	STP		8D	Step
	STM		B1	Step continue

Table 1-5. Step/Scan Lockout Remote Commands (Cont'd)

ASCII Command	ASCII Response	HEX Command	HEX Response	Description
PAR n		21b		Partition memory to number of storage channels in memory. (0-71)
PAR?	PAR n	23	21b	Returns number of present storage channels available.
QUE?	QUE	26	24	Returns frequencies in queue with none present.
	QUE,f,f...		24pppp pppp...	Maximum of 16 frequencies in the queue.
RCE n		27 b		Recalls and executes memory channel in statement.
RCH n	SCH mch,chn,frq,bw,cor,det,afc,agc,rfg,bfo	2A b	30 b b ppp b b b b b b ppp	Recalls channel in format of SCH command below.
RLK n	LKF f,f	2D b b	1E p p p p p p p	Returns center frequency and width of Lockout channel in memory channel n.
SCH mch,chn,frq,bw,cor,det,afc,agc,rfg,bfo 30 b b pppp b b b b b b pppp				Stores channel command binary version mch - memory channel number chn - channel flag (CHN,CHN/) frq - frequency (in MHz) bw - bandwidth (1-5) cor - cor level (0-81) det - detection (AM,FM,CW, PLS,USB,LSB,ISB) afc - (AFC,AFC/) agc - (AGC,AGC/) rfg - rf gain (0-255) bfo - bfo frequency in kHz
SCI f		06 p p p p		Scan increment frequency (in MHz), from 10 kHz to 1 MHz in 10 kHz increments. (SCI 0 selects FBW,FWB/)
SCI?	SCI f	08	06 p p p p	Returns current scan increment.
SCN		84		Continues Scan from scan continue operation. Uses previous issued channel.

Table 1-5. Step/Scan Lockout Remote Commands (Cont'd)

ASCII Command	ASCII Response	HEX Command	HEX Response	Description
SCN n		84 b		Starts Scan using channel specified in statement. Scans from memory channel n to memory channel n +1.
SCN n-n		84 b b		Starts scan using first memory channel n as start channel and the second as stop channel.
STO n		8A b		Stores current active receiver parameters in memory channel n.
STP		8D		Continues Step from step continue operation. Uses previous issued channel.
STP n		8D b		Starts Step using channel specified in statement. Scans from 0 to memory channel n
STP n-n		8D b b		Starts Step using first memory channel n as start channel and second as stop channel.
STP n,n,n ...		8E b b b b...		Starts Step with user defined channel sequence
ULC n		33 b b		Unlocks channel number n in command.
ULF f		36 p p p p		Unlocks center frequency n in command.

Legend

chr	used in command	used in response
b	Is a single byte of data	Is a single byte of data
p	Is a packed BCD byte of data	Is a packed BCD byte of data
n	Is 1-3 ASCII digits used as a number	Is a space and 3 ASCII digits
f	Is a maximum of 4 ASCII digits, a decimal and 4 more ASCII digits	Is a space, 4 ASCII digits, a decimal and 4 ASCII digits.

Table 1-6. Error Messages

Remote Errors for WJ-8615/SSL
Returned by sending ERR? command

Error			
Local	Remote	Cause	Result
	00	No Error	
221	21	First LO unlocked for >75 ms.	Hardware failure.
222	22	Second LO unlocked for >75 ms.	Hardware failure.
223	23	Third LO unlocked for >75 ms.	Hardware failure.
230	30	Protected RAM error detected.	Receiver returns to all defaults including reading programming switches.
233	33	Fine tune reference out of tolerance	Hardware failure, 2nd Lo is not able to calibrate or work properly.
234	34	Unable to calibrate 2nd LO.	Hardware failure, improper 2nd LO operation.
401	01	488 input buffer overflow, >80 characters.	Buffer will be dumped, input pointer reset to beginning.
402	02	Illegal message format, <2 characters in ASCII.	Message from error to teminator is ignored.
404	04	Number is out of range for this command.	Message from error to terminator is ignored.
405	05	"/" or "?" is not valid for this command.	Message from error to terminator is ignored.
407	07	Invalid mnemonic or binary command.	Message from error to terminator is ignored.
418	18	This message not valid for WJ-8615	Message ignored.
470	70	Permission to calibrate requested	Remote should send the CAP command
471	71	Calibration in progress	Receiver will ignore any commands received. Querys are okay.
472	72	Calibration is complete.	Receiver is returned to previous status.
	73		
551	51	No more lockout space in lockout Memory	Lockout ignored. Repartition memory.
552	52	Attempt to store a memory channel > partition limit.	Store channel ignored. Repartition memory.
810	10	Attempt to scan/step undefined channel	Command ignored
813	13	Attempt to scan with start frequency ≥ stop	Command ignored
814	14	Attempt to select an illegal band-width slot. (no bandwidth in slot)	Command ignored
815	15	Attempt scan/step without a valid calibration	Scan/Step command ignored. Sent CAP if no hardware failure.
816	16	Attempt to unlock a non-existant lockout frequency	Command ignored
817	17	Attempt to scan or step when the receiver has been on <45 minutes.	Scan/step allowed. Be aware of calibration check required each 2-3 minutes.

1.7 SCAN AND STEP TIMES

The time duration required for the receiver to perform a Step or Scan function depends on the mode selected the type of filter used and several other factors.

1.7.1 SCAN TIME

Scan time is a function of various factors. For Scan time, these factors include: the distance between Start and Stop frequencies; the number of scan increments from start to stop frequencies, the size of the frequency increment, where the scan lies within the tuning range of the receiver. The numbers given below will allow calculations of the typical time for any given scan.

A. Scan points that do not cross 5 MHz boundries or frequency extender band breaks. These times assume no narrow bandwidth compensation for non Gaussian filters.

1. Time per Scan frequency increment without preselector.

a. Base time per point ..... 330 µsec
b. With preselector on; add per point ..... 45 µsec
c. With non Gaussian filters:

10 kHz filter selected add	200 µsec
15 kHz filter selected add	200 µsec
20 kHz filter selected add	100 µsec
30 kHz filter selected add	100 µsec
50 kHz filter selected add	50 µsec
100 kHz filter or greater selected add	0 µsec

2. Total time per point 1a plus 1b and 1c (if required because of non gaussian filters).

B. Scan points that cross 5 MHz boundarys.

1. Lock time for 1st LO (3-10 ms) plus 500 µs. Typical 7 msec.

C. Scan points that cross frequency extender bands.

1. Frequency extender turn on band change 30 msec.

To calculate a total Scan time multiply the number of points not crossing 5 MHz by time in **A.** Add the product of the number of 5 MHz boundrys crossed and **B.** Add the product of the number of frequency extender band breaks crossed and **C.** This sum should be the total time to Scan from start to stop frequency.

In order to maximize scan and step speed, special IF bandwidth filters are included with the SSL option whenever 10 kHz, 20 kHz, 25 kHz,

or 50 kHz filters are chosen. These filters are transitional gaussian-to-6 dB that provide a faster transient response. However, the shape factor is specified at 3:1 60 dB to 6 dB instead of 3:1 60 dB to 3 dB. When improved I.F. shape factor is required, standard filters can be specified at the sacrifice of slower scan and step times.

1.7.2 STEP TIME

The Step time for each channel to sequence through preprogrammed channels depends on various factors. If a 5MHz boundry is crossed or a frequency extender band is changed Step times are:

A.	Step time without crossing 5MHz boundaries.	typical 1.5 msec
B.	Step time crossing a 5MHz boundry.	typical 7.0 msec
C.	Step time changing frequency extender bands.	typical 30.0 msec

Example

1.	Start frequency	120 MHz.	
2.	Stop frequency	140 MHz.	
3.	Bandwidth	20 kHz.	(Gaussian-to-6dB)
4.	Scan increment	20 kHz.	
5.	Preselector	off	

Scan time per point	330 µS
Total numer of points	1000
Number of 5 Mhz boundaries crossed	4
Number of frequency extender band breaks crossed	0

Total scan time = .33mS x 1000 + 4 x 7mS = .358 seconds.

1.8 SSL RETROFIT

Installing the Step/Scan Lockout into a receiver requires the following components:

Type 796244-3 Analog/Digital module A1A4
Type 796242-4 Microprocessor module A1A3
Type 776004-3 2nd LO Synthesizer A1A6
Version E03 software

When SSL is installed in a receiver, two speeds (fast or slow) are selectable. Slow operation is provided for use with standard IF filters. Standard IF filters provide slower response times during SSL operation. The specialized Gaussian filter's shape factor is slightly less than the Non-gaussian filters. However, the specialized gaussian filters provided faster Step and Scan times.

SSL rate is determined by the setting of Switch 1 position 4, on the IEEE-488/Interrupt module (A1A2). With switch position 4 in the OPEN position, slow SSL is selected for non-gaussian filters. Placing position 4 in the CLOSED position, fast SSL mode is selected and gaussian filters may be utilized.

Type 776004-3 Analog/Digital module A1A6 is a modified version of the the Type 776004-1 Analog/Digital module. Refer to **Figure 1-1** for the Type 776004-3 schematic drawing.

Type 796242-4 Microprocessor A1A3 is a modified version of the 796242-1 Microprocessor. The modified version is jumper wired for two type 27128 EPROMS and two type 6116 RAM chips.

1.9 PARTS LIST

The following parts list reflects module changes used in the WJ-8615D Receiver.

1.9.1 **Type 776004-3 2nd LO Synthesizer** REF DESIG PREFIX **A1A6**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 10 V	4	196D226X0010JE3	56289	
C2	Capacitor, Ceramic, Chip: 4700 pF, 10%, 50 V	3	C1210C472K5XAH	31433	
C3	Capacitor, Ceramic, Disc: .01 µF, 20%, 50 V	25	34453-1	14632	
C4	Capacitor, Ceramic, Chip: 470 pF, 10%, 100 V	13	C1210E471K1GAH	31433	
C5 Thru C8	Same as C4				
C9	Capacitor, Electrolytic, Tantalum: 100 µF, 20%, 10 V	1	MMJ-010-107R-20	14674	
C10	Same as C2				
C11	Same as C4				
C12	Same as C4				
C13	Same as C4				
C14	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	8	34475-1	14632	
C15	Same as C4				
C16	Capacitor, Ceramic, Chip: 4.3 pF, ±0.55 pF, 500 V	1	ATC700B4R3CP500X	29990	
C17	Capacitor, Ceramic, Chip: 6.2 pF, 500 V	1	ATC100B6R2BP500X	29990	
C18	Capacitor, Ceramic, Chip: 200 pF, 50%, 500 V	2	32-257578-40	91984	
C19	Same as C4				
C20	Same as C18				
C21	Capacitor, Ceramic, Disc: .1 pF, 20%, 50V 2.2 µF, 20%, 35 V	6	34575	14632	
C22	Same as C2				
C23 Thru C28	Same as C3				
C29	Not Used				
C30	Not Used				
C31	Same as C3				
C32	Same as C14				
C33	Same as C32				
C34	Same as C32				
C35	Same as C21				
C36	Same as C21				
C37	Same as C32				
C38	Same as C1				
C39	Not Used				
C40	Same as C3				
C41	Capacitor, Electrolytic, Tantalum: 150 µF, 20%, 6 V	2	MMJ-606-157R-20	17554	
C42	Same as C1				
C43	Same as C1				
C44	Capacitor, Ceramic, Disc: .47 µF, 20%, 50 V	3	34452-1	14632	
C45	Capacitor, Ceramic, Chip: 470 pF, 20%, 200 V	1	ATC100B471MP	29990	

REF DESIG PREFIX **A1A6**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C46	Same as C3				
C47	Capacitor, Ceramic, Chip: 47 pF, 5%, 500 V	1	ATC100B470JP500	29990	
C48	Capacitor, Ceramic, Chip: 6.2 pF, ±0.25 pF, 500 V	1	ATC700B6R2CP500X	29990	
C49	Not Used				
C50	Capacitor, Ceramic, Chip: 4.7 pF, ±0.1 pF, TOL, 500 V	1	ATC100B4R7BP500X	29990	
C51	Same as C4				
C52 Thru C61	Same as C3				
C62	Same as C21				
C63	Same as C21				
C64	Capacitor, Electrolytic, Tantalum: 4.7 µF, 20%, 35 V	1	196D475X0035JE3	56289	
C65	Same as C21				
C66 Thru C69	Same as C3				
C70	Same as C44				
C71	Capacitor, Electrolytic, Tantalum: 47 µF, 20%, 20 V	1	196D476X0020PE4	56289	
C72	Capacitor, Electrolytic, Tantalum: 100 µF, 20%, 20 V	1	196D107X0020TE4	56289	
C73	Same as C41				
C74	Same as C44				
C75	Capacitor, Ceramic, Disc: 470 pF, 20%, 1000 V	2	BHD470-20PCT	91418	
C76	Same as C75				
C77	Same as C3				
C78	Capacitor, Ceramic, Monolithic: 30 pF, ±2%, 100V	1	150-100-NPO-3006	51642	
CR1	Diode	4	U11-3102	52673	
CR2	Same as CR1				
CR3	Diode	3	1N4449	80131	
CR4	Same as CR3				
CR5	Diode	2	1N4446	80131	
CR6	Diode	2	1N754A	80131	
CR7	Same as CR1				
CR8	Same as CR1				
CR9	Same as CR5				
CR10	Same as CR3				
J1	Connector, Receptacle, SMB	1	212	19505	
L1	Coil, Fixed: 1.0 µF, 10%	1	1537-12	99800	
L2	Coil, Fixed: 30 µH, 5%	2	1537-50	99800	
L3	Same as L2				
L4	Coil, Fixed, Molded: 0.1 µH	1	1025-94	99800	
L5	Coil, Fixed, Molded: .22 µH, 10%	3	1025-04	99800	

REF DESIG PREFIX **A1A6**

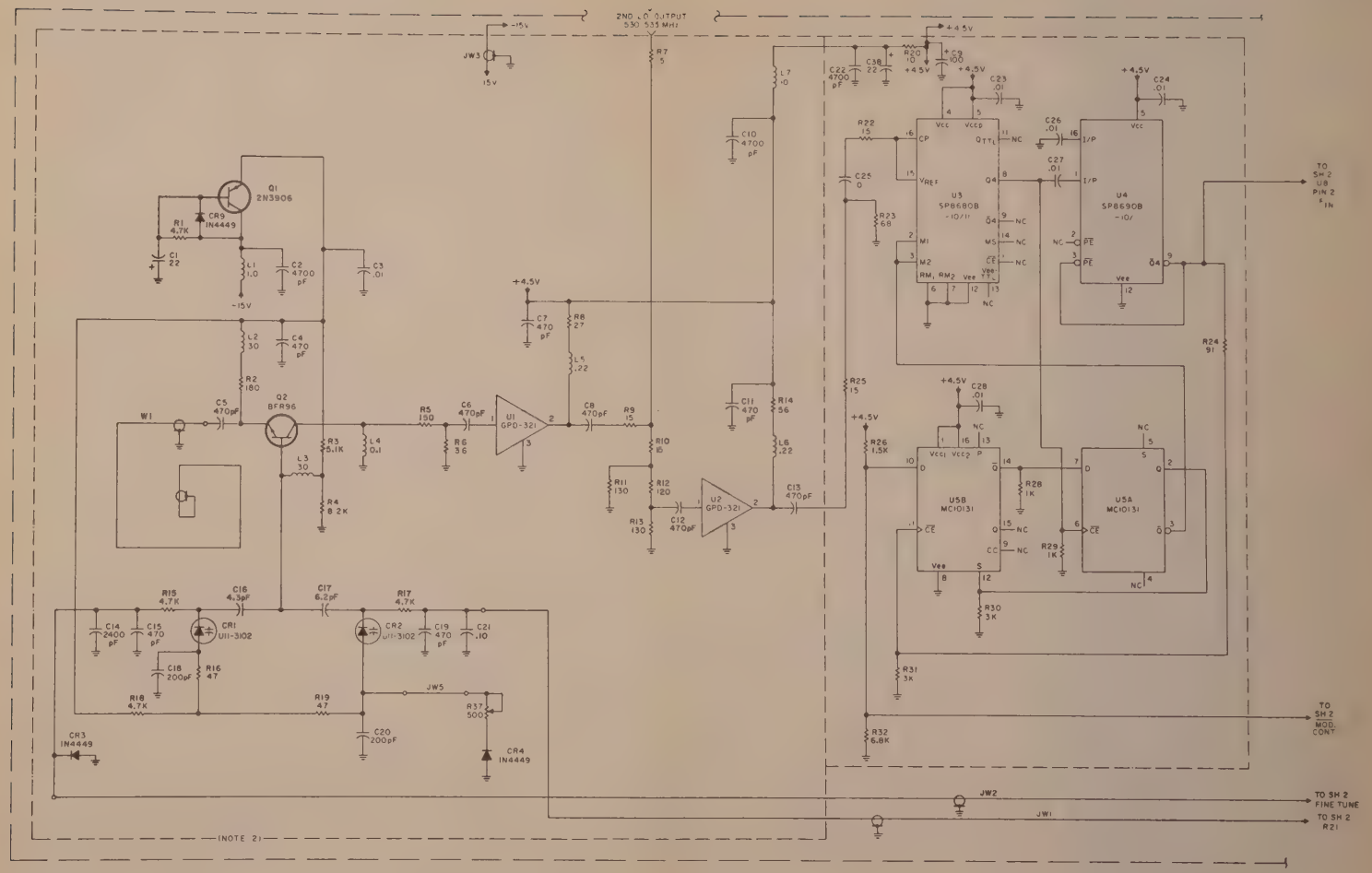
REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L6	Same as L5				
L7	Coil, Fixed: 10 µH, 10%	2	1537-36	99800	
L8	Not Used				
L9	Not Used				
L10	Coil	1	1129-52	14632	
L11	Same as L5				
L12	Inductor	4	170134-1	14632	
L13	Same as L12				
L14	Same as L12				
L15	Same as L12				
L16	Inductor	1	21209-38	14632	
P1	Receptable Assembly	1	102585-8	00779	
Q1	Transistor	1	2N3906	80131	
Q2	Transistor	1	BFR96	73445	
Q3	Transistor	1	2N2222A	80131	
Q4	Transistor	1	2N2270	80131	
Q5	Transistor	1	U310	17856	
R1	Resistor, Fixed, Film: 4.7 kΩ, 5%, 1.8 W	10	CF1/8-4.7K/J	09021	
R2	Resistor, Fixed, Film: 180Ω, 5%, 1/8 W	1	CF1/8-180 OHMS/J	09021	
R3	Resistor, Fixed, Film: 5.1 kΩ, 5%, 1/8 W	1	CF1/8-5.1K/J	09021	
R4	Resistor, Fixed, Film: 8.2 kΩ, 5%, 1/8 W	1	CF1/8-8.2K/J	09021	
R5	Resistor, Fixed, Film: 150Ω, 5%, 1/8 W	1	CF1/8-150 OHMS/J	09021	
R6	Resistor, Fixed, Film: 36Ω, 5%, 1/8 W	1	CF1/8-36 OHMS/J	09021	
R7	Resistor, Fixed, Film: 15Ω, 5%, 1/8 W	5	CF1/8-15 OHMS/J	09021	
R8	Resistor, Fixed, Film: 27Ω, 5%, 1/8 W	3	CF1/8-27 OHMS/J	09021	
R9	Same as R7				
R10	Same as R7				
R11	Resistor, Fixed, Film: 130Ω, 5%, 1/8 W	2	CF1/8-130 OHMS/J	09021	
R12	Resistor, Fixed, Film: 120Ω, 5%, 1/8 W	3	CF1/8-120 OHMS/J	09021	
R13	Same as R11				
R14	Resistor Fixed, Film: 56Ω, 5%, 1/8 W	2	CF1/8-56 OHMS/J	09021	
R15	Same as R1				
R16	Resistor, Fixed, Film: 47Ω, 5%, 1/8 W	3	CF1/8-47 OHMS/J	09021	
R17	Same as R1				
R18	Same as R1				
R19	Same as R16				
R20	Resistor, Fixed, Film: 10Ω, 5%, 1/4 W	1	CF1/4-10 OHMS/J	09021	
R21	Same as R1				
R22	Same as R7				
R23	Resistor, Fixed, Film: 68Ω, 5%, 1/8 W	1	CF1/8-68 OHMS/J	09021	
R24	Resistor, Fixed, Film: 91Ω, 5%, 1/8 W	2	CF1/8-91 OHMS/J	09021	

REF DESIG PREFIX **A1A6**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R25	Same as R7				
R26	Resistor, Fixed, Film: 1.5 kΩ, 5%, 1/8 W	4	CF1/8-1.5K/J	09021	
R27	Resistor, Fixed, Film: 2.7Ω, 5%, 1/8 W	1	CF1/8-2.7 OHMS/J	09021	
R28	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/8 W	6	CF1/8-1.0K/J	09021	
R29	Same as R28				
R30	Resistor, Fixed, Film: 3 kΩ, 5%, 1/8 W	3	CF1/8-3K/J	09021	
R31	Same as R30				
R32	Resistor, Fixed, Film: 6.8 kΩ, 5%, 1/8 W	2	CF1/8-6.8K/J	09021	
R33	Same as R30				
R34	Resistor, Variable, Film: 100 kΩ, 10%, 1/4 W	1	3262W1-104	80294	
R35	Resistor, Variable, Film: 5 kΩ, 10%, 1/4 W	1	3262X-1-502	80294	
R36	Resistor, Fixed, Film: 10 kΩ, 5%, 1/8 W	6	CF1/8-10K/J	09021	
R37	Resistor, Variable, Film: 500Ω	1	3262W1-501	80294	
R38	Same as R36				
R39	Same as R36				
R40	Same as R40				
R41 Thru R44	Not Used				
R45	Same as R1				
R46	Resistor, Fixed, Film: 330 kΩ, 5%, 1/8 W	2	CF1/8-330K/J	09021	
R47	Same as R46				
R48	Resistor, Fixed, Film: 4.7 kΩ, 5%, 1/8 W	1	C3-4.7K-5PCT	24546	
R49	Resistor, Fixed, Film: 6.8 kΩ, 5%, 1/8 W	1	CF1/8-6.8K/J	09021	
R50	Not Used				
R51	Not Used				
R52	Same as R1				
R53	Resistor, Fixed, Film: 2.7 kΩ, 5%, 1/8 W	4	CF1/8-2.7K/J	09021	
R54	Not Used				
R55	Same as R36				
R56	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	3	CF1/8-100 OHMS/J	09021	
R57	Resistor, Fixed, Film: 330Ω, 5%, 1/8 W	1	CF1/8-330 OHMS/J	09021	
R58	Same as R28				
R59	Resistor, Fixed, Film: 22Ω, 5%, 1/8 W	1	CF1/8-22 OHMS/J	09021	
R60	Same as R36				
R61	Same as R36				
R62	Resistor, Fixed, Film: 680Ω, 5%, 1/8 W	1	CF1/8-680 OHMS/J	09021	
R63	Resistor, Fixed, Film: 820Ω, 5%, 1/8 W	1	CF1/8-820 OHMS/J	09021	
R64	Same as R14				
R65	Not Used				
R66	Same as R12				

REF DESIG PREFIX **A1A6**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R67	Same as R12				
R68	Same as R28				
R69	Same as R53				
R70	Same as R1				
R71	Resistor, Fixed, Film: 47 kΩ, 5%, 1/8 W	1	CF1/8-47K/J	09021	
R72	Same as R1				
R73	Same as R53				
R74	Same as R28				
R75	Resistor, Fixed, Film: 3.3 kΩ, 5%, 1/8 W	1	CF1/8-3.3K/J	09021	
R76	Same as R32				
R77	Same as R26				
R78	Same as R53				
R79	Same as R24				
R80	Same as R26				
R81	Same as R26				
R82	Not Used				
R83	Same as R28				
R84	Resistor, Fixed, Film: 470Ω, 5%, 1/8 W	1	CF1/8-470 OHMS/J	09021	
R85	Same as R56				
R86	Same as R16				
R87	Resistor, Fixed, Film: 270Ω, 5%, 1/8 W	1	CF1/8-270 OHMS/J	09021	
U1	Amplifier	3	GPD-321	24539	
U2	Same as U1				
U3	Program Divider by 10/11	1	SP8680B	52648	
U4	Divide by 10/11	3	SP8690B	52648	
U5	ECL Dual Flip-Flop, Type D	2	MC10131L	04713	
U6	Single Low Noise Operational Amplifier	1	NE5534N	18324	
U7	4-Bit Data Bus Input PLL Frequency Synthesizer	2	MC145146P	04713	
U8	Same as U1				
U9	Two Modulus Prescaler	2	SP8685B	52648	
U10	Same as U9				
U11	Same as U5				
U12	Same as U4				
U13	Same as U4				
U14	Same as U7				
U15	Analog Switch	1	DG303CJ	17856	
VR1	Diode	1	LM329CZ	27014	
VR2	Diode	1	1N754A	80131	
W1	Cable Assembly Coaxial	1	280565-1	14632	



NOTES:
1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS IN OHMS, ± 5%, 1/8 W.
   b) CAPACITANCE IS IN μF.
   c) INDUCTANCE IS IN μH.
2. — — — INDICATES SHIELDING COVER.

VR	VR2	
U	U13	
R	R87	R39, R41-44, R50, R51, R54, R65, R82
Q	Q5	
L	L16	L8
JW	JW5	
CR	CR9	CR5, CR6
C	C77	C39, C49
REF DESIG	LAST USED	NOT USED

Figure 1-1. Type 776004-3, 2nd LO Synthesizer (A1A6), Schematic Diagram 580408 (Sheet 1 of 2)

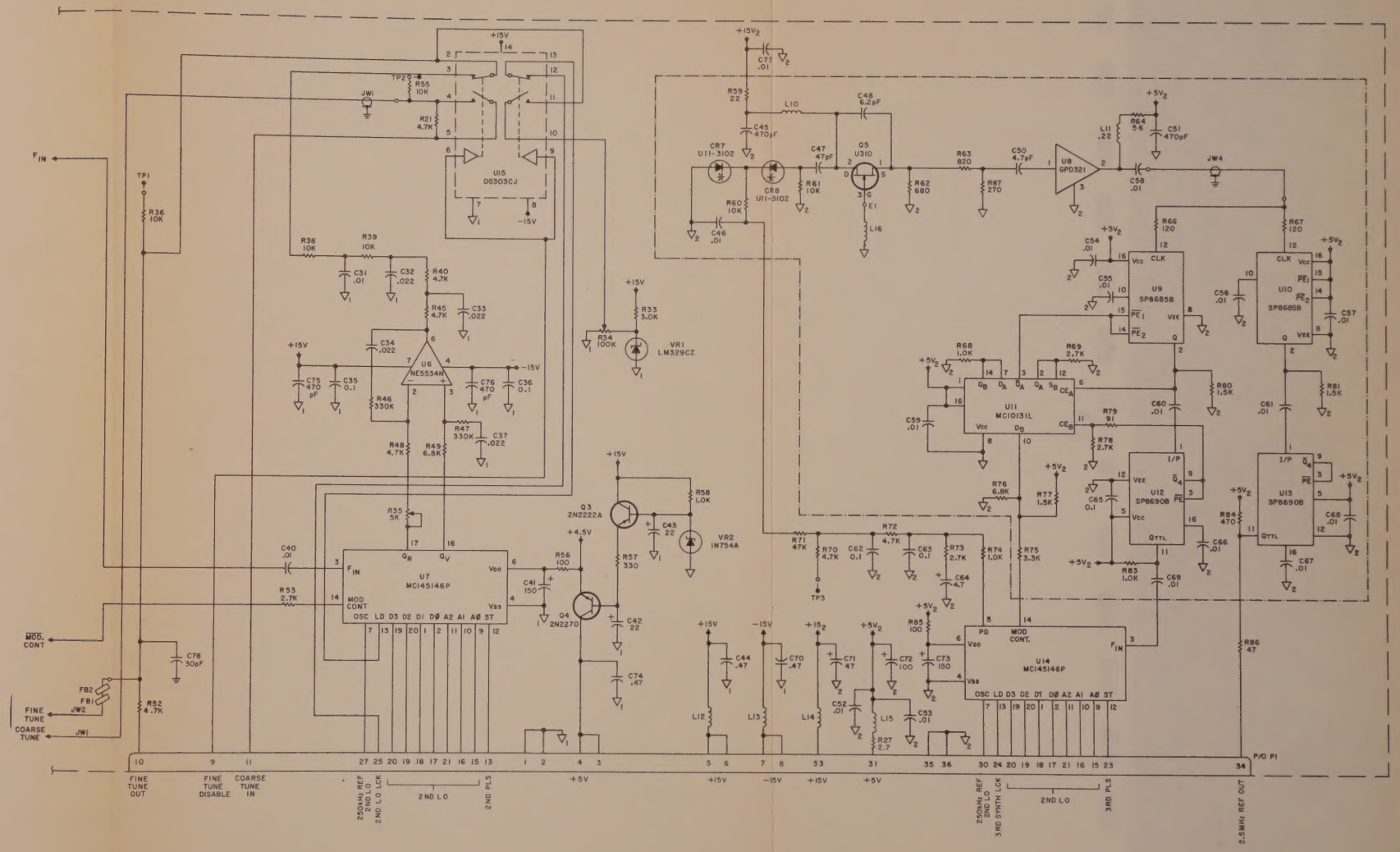


Figure 1-1. Type 776004-3, 2nd LO Synthesizer (A1A6), Schematic Diagram 580408 (Sheet 2 of 2)

MP MASTER
MA31068